Effects of relative humidity on aerosol light scattering

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In the field, continuous measurements of aerosol light scattering are often performed under dry conditions (relative humidity RH < 30-40%) which differ from ambient, climate relevant ones. Since ambient aerosol particles experience a hygroscopic growth at enhanced RH, their microphysical and optical properties are strongly dependent on RH. The knowledge of the RH dependence is of eminent importance e.g. for climate models and for the comparison of ground based observations with remote sensing data. The goal of this study is to investigate the effects of RH on aerosol optical properties for different aerosol types. For this, we installed a newly developed humidified nephelometer (WetNeph) at different European measurement sites. The WetNeph measures the aerosol scattering coefficient at controlled RH.

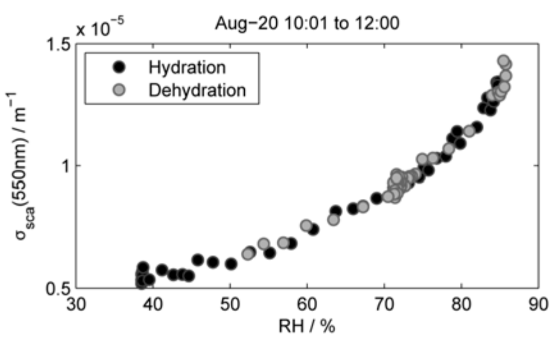

Figure 1: Humidogram of the aerosol light scattering coefficient (at 550nm) measured at Zeppelin station, Ny-Ålesund, Spitsbergen.

Figure 1 demonstrates the effect of RH on the scattering coefficient of arctic aerosol. Compared to the dry conditions the scattering is enhanced at 85% RH by a factor of ~2.5 on that day. At Jungfraujoch, Switzerland, scattering enhancement of up to 3.5 has been observed in May 2008 (not shown). Here, we will present results of our comprehensive field campaigns performed at Jungfraujoch and at Zeppelin station, Spitsbergen.

Silicon isotope fractionation between silicate and metal from an enstatite meteorite

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We have investigated the isotope fractionation between Si in metal and Si in silicate in meteorites in order to test the assertion that there is a strong Si isotope fractionation between core and mantle during planet formation [1].

Mt. Egerton (USNM 3272) is an enstatitic meteorite formed from E-chondrites. It consists mainly of coarse-grained enstatite and metal, the latter with 2.06 wt.% Si. Our MC-ICPMS acid digestion analyses show that the $\delta^{30}Si_{NBS-28}$ value of Si in the metal is 5.3 ‰ lower than that of Si in the enstatite. This fractionation from a natural system confirms results of recent experiments by Shahar *et al.* [2], which show a large $^{30}Si/^{28}Si$ fractionation between Si in silicate and Si in metal at high temperatures. The natural data exhibit a larger fractionation than that observed in the laboratory, likely due to the lower formation temperature of Mt Egerton.

We show that the slow rate of Si tracer diffusion in silicate, despite a more rapid tracer diffusion rate in FeSi, rules out post-crystallization diffusive resetting of Si isotope ratios. Therefore, the measured $\Delta^{30}Si_{(silicate\text{-}metal)}$ is reflective of the crystallisation temperature of the meteorite. Theoretical Si isotope fractionation calculations [1], combined with experimentally obtained fractionations [2], predict a temperature of 1145 K (872°C) for a $\Delta^{30}Si_{(silicate\text{-}metal)}$ of 5.3 ‰. Such a temperature is reasonable for this rock [3, 4]. We conclude that $\Delta^{30}Si_{(silicate\text{-}metal)}$ has potential as a thermometer.

The differences in $\delta^{30}Si$ between metal and silicate, now demonstrated in meteorites and in the laboratory, show that Si isotopes can be used to constrain the amount of Si in Earth's core and/or the degree of equilibration during core formation.

[1] Georg *et al*. (2007) *Nature* **447** 1102-1106. [2] Shahar *et al*. (2008) *GCA* 72/**12** Suppl. 1 A848. [3] Biswas *et al.* (1980) *GCA* **44** 2097-2110. [4] Wasson *et al.* (1994) Meteoritics **29/5** 658-662.